

WHAT IS CLAIMED IS:

1. An axial flow blood pump comprising:
 - a pump housing having an inlet and an outlet;
 - a pump stator contained within said pump housing;
 - 5 a pump rotor rotatably disposed within said pump stator, said pump rotor including an axial shaft;
 - a motor including a motor rotor contained within said pump housing, said motor rotating said motor rotor; and
 - a direct drive means coupled to said axial shaft of said pump rotor for
 - 10 rotating said pump rotor,
 - wherein said rotation of said pump rotor within said pump stator forms a plurality of cavities, said cavities carrying blood forward through said pump housing from said inlet to said outlet as said motor drives said direct drive means.
- 15 2. An axial flow blood pump as defined in Claim 1, wherein said cavities progress in a straight line path through the pump.
3. An axial flow blood pump as defined in Claim 1, wherein said pump stator is connected to said motor rotor for rotation therewith.
- 20 4. An axial flow blood pump as defined in Claim 1, wherein said direct drive means is coupled between said motor rotor and said pump rotor axial shaft for rotating said pump rotor.
- 25 5. An axial flow blood pump as defined in Claim 4, wherein said direct drive means comprises a gear fixed to said axial shaft of said pump rotor, said gear including a plurality of external teeth, and a drive element connected to said motor

rotor, said drive element including a plurality of internal teeth engaging said external teeth of said pump rotor shaft gear.

5 6. An axial flow blood pump as defined in Claim 5, wherein said drive element is connected with said motor rotor by a key and slot arrangement.

10 7. An axial flow blood pump as defined in Claim 5, wherein said rotor shaft gear includes $m \cdot n$ external teeth and said drive element includes $m \cdot (n+1)$ internal teeth, wherein m and n are integers.

15 8. An axial flow blood pump as defined in Claim 5, wherein said drive element includes twice as many internal teeth as there are external teeth of said pump rotor shaft gear so that said pump rotor is driven approximately twice as fast as said motor rotor.

 9. An axial flow blood pump as defined in Claim 5, wherein said drive element defines an opening for allowing blood flow past said drive element.

20 10. An axial flow blood pump as defined in Claim 9, wherein said opening defined by said drive element is aligned with an open cavity formed between said pump shaft and said pump rotor.

25 11. An axial flow blood pump as defined in Claim 1, wherein said motor further includes a motor stator for rotating said motor rotor, said motor stator having at least one pair of windings, said pair of windings being arranged on opposite sides of said motor stator and being connected in parallel to reduce unbalanced magnetic forces.

12. An axial flow blood pump as defined in Claim 11, wherein said motor stator is contained between an inner pump housing wall and an outer pump housing wall.
- 5 13. An axial flow blood pump as defined in Claim 11, wherein said motor stator and said motor rotor comprise longitudinally spaced segments.
- 10 14. An axial flow blood pump as defined in Claim 13, wherein said motor rotor further comprises an outer sleeve for supporting said motor rotor segments, said drive element being connected to said outer sleeve.
- 15 15. An axial flow blood pump as defined in Claim 1, wherein the axial flow blood pump is mounted vertically with said outlet facing downward.
- 15 16. An axial flow blood pump as defined in Claim 15, further comprising a motion limiter for limiting vertical movement of said motor rotor.
- 20 17. A method for pumping blood through an axial flow pump including an inlet and an outlet, the method comprising the steps of:
directly rotating a pump rotor rotatably mounted within a pump stator of said pump with a motor of said pump thereby forming a plurality of moving cavities between said pump rotor and said pump stator; and
carrying blood from said inlet to said outlet via said moving cavities.
- 25 18. A method for pumping blood as defined in Claim 17, wherein said motor includes a motor rotor and said pump rotor is directly rotated by a direct drive means coupling said motor rotor and an axial shaft of said pump rotor.

19. A method for pumping blood as defined in Claim 18, wherein said direct drive means comprises a gear fixed to said axial shaft of said pump rotor, said gear including a plurality of external teeth, and a drive element connected to said motor rotor, said drive element including a plurality of internal teeth engaging said external teeth of said pump rotor shaft gear.

20. A method for pumping blood as defined in Claim 18, wherein said pump rotor is driven approximately twice as fast as said motor rotor.

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21. A method for pumping blood as defined in Claim 17, wherein said moving cavities progress in a straight line path through the pump.

22. A method for pumping blood as defined in Claim 17, further comprising the step of rotating said pump stator with said motor.

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